

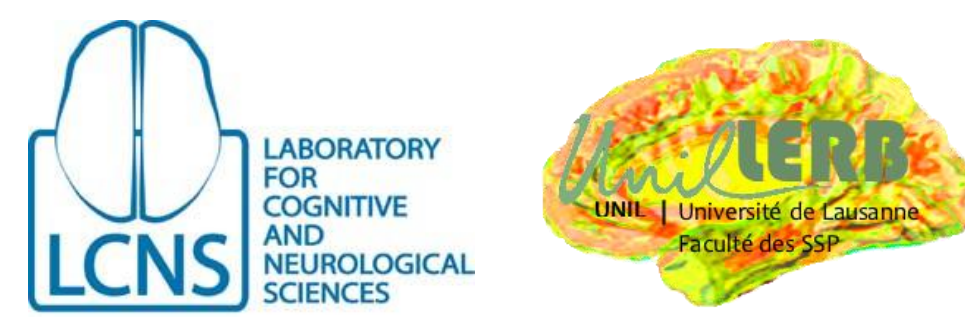
Early attentional processes distinguish selective from global motor inhibitory control: an electrical neuroimaging study

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Introduction

The rapid stopping of specific parts of movements is frequently required in daily life. Yet, whether selective inhibitory control of movements is mediated by a specific neural pathway or by the combination between a global stopping of all ongoing motor activity followed by the re-initiation of task relevant movements remains unclear.

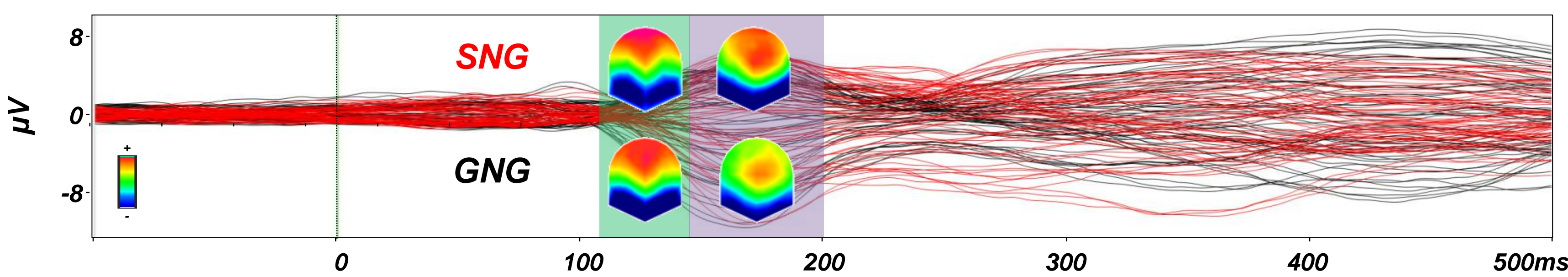
To address this question, we analyzed electrical neuroimaging responses to global vs selective inhibition stimuli presented during a Go/NoGo task. Participants had to respond as fast as possible with their two hands to Go stimuli (66% of the trials) and to withhold the response from the two hands (global inhibition conditions, GNG, 16% of the trials) or from only one hand (selective inhibition, SNG, 16%) when specific NoGo stimuli were presented.

Conclusions

- Behaviorally, we replicate stopping interference effects (RT: SNG > Go) [1,2]
- We corroborate and extend the combination model of reactive selective inhibitory control:
 - Both selective and global motor inhibitory control depend on global stopping mechanisms
 - Yet, selective and global inhibition differ quantitatively at early latency within visual & attentional areas.
- Higher attention in the GNG condition could have helped speeding up the triggering of prefrontal top-down inhibitory processes to reach fast global inhibition. In contrast, inhibitory processes had to be engaged with more restraint in the SNG condition to reduce the amount of interference induced by the global inhibition on the execution of the alternative response.

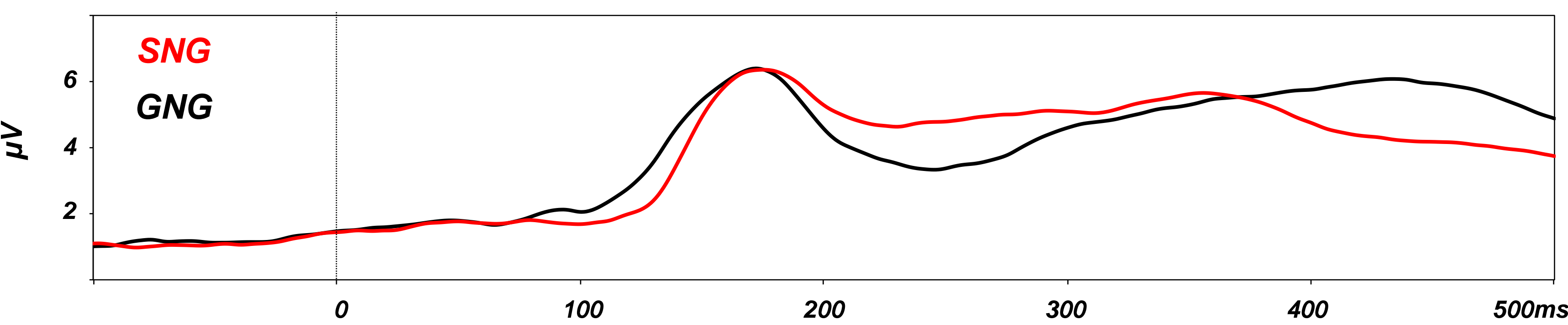
Electrical Neuroimaging results Selective (SNG) vs. Global (GNG) inhibition

a. Superimposed ERP waveforms



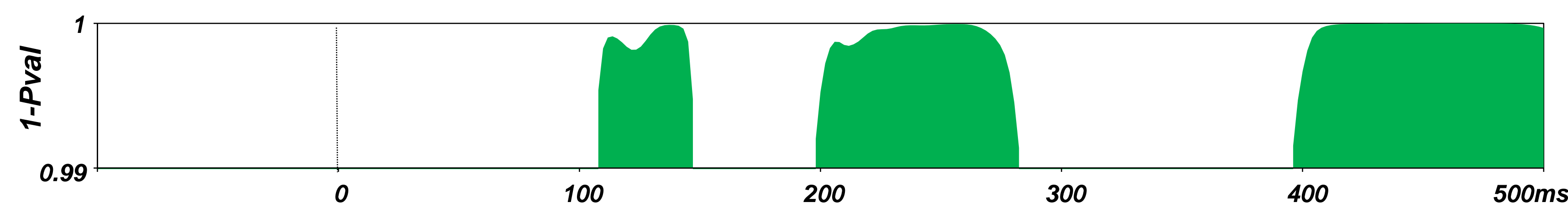
a. Superimposed ERP waveforms across all electrodes for the two experimental conditions with the topography of the potential field for the SNG (up) and GNG (bottom) shown for the two period of interest (GFP and Topographic modulation)

b. Global Field Power waveforms



b. Global field power (GFP) waveforms across time in the SNG (red) and GNG (black) conditions.

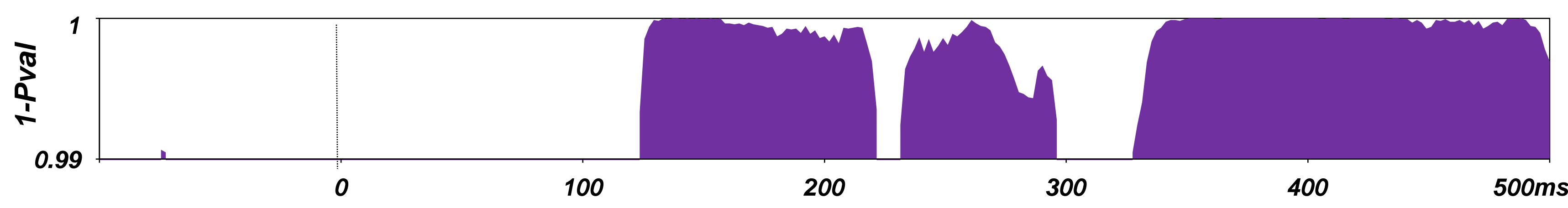
c. Global Field Power: GNG vs SNG time-wise t-tests



c. Time-wise t-tests on the GFP revealed significant modulations between the GNG and the SNG conditions at 110-150 ms, at 200-280 ms and at 400-500 ms.

→ GFP modulation without concomitant topographic modulations from 110 to 150 ms, indicates the engagement of the same configuration of brain generators, but stronger for global than for selective inhibition.

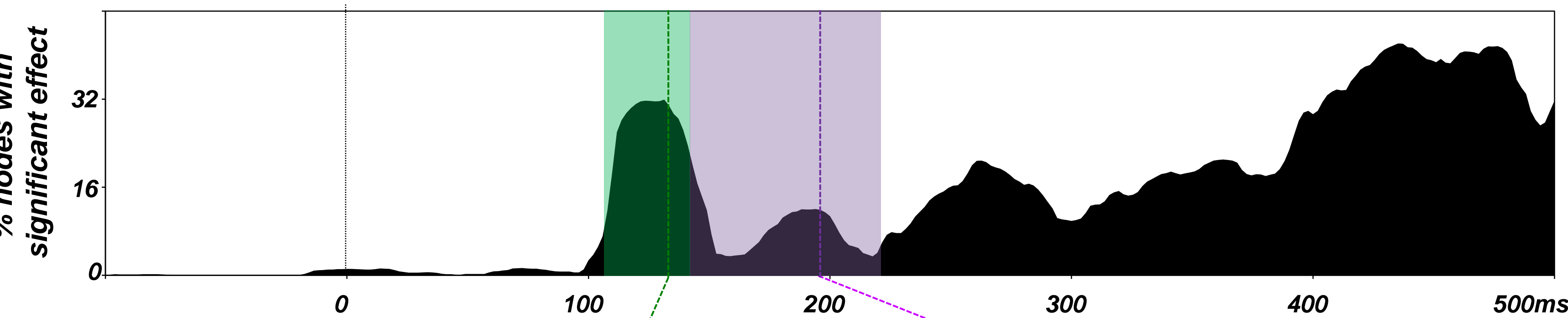
d. Global Map Dissimilarity (Topographic modulation): GNG vs SNG



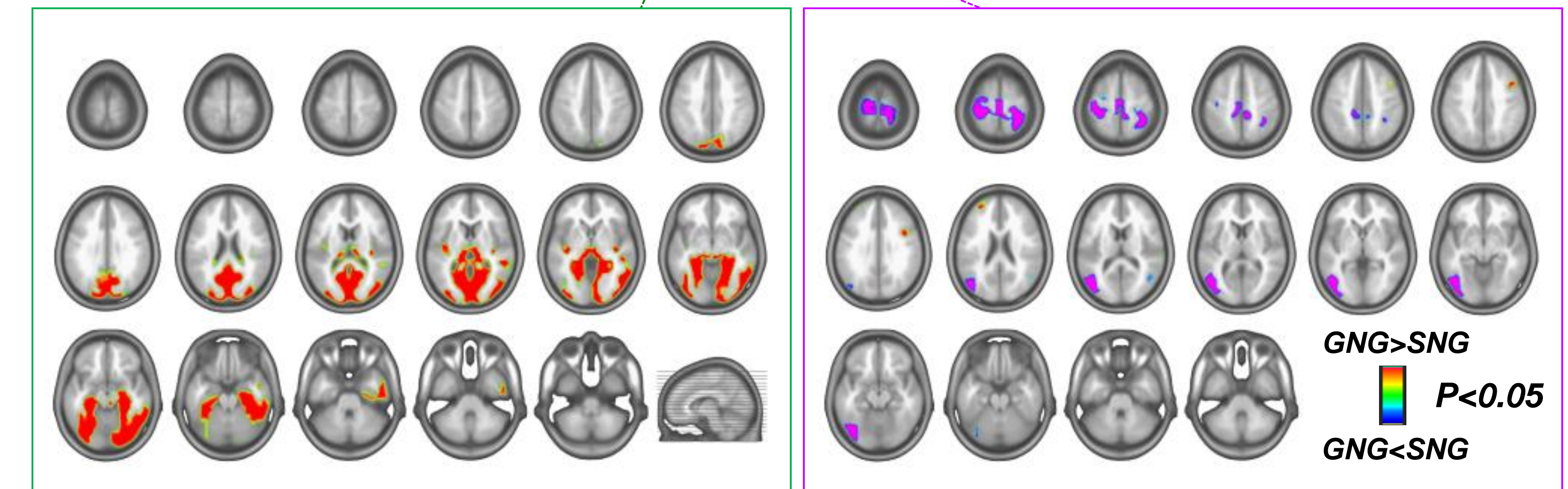
d. The Global Map Dissimilarity (GMD) analysis revealed significant topographic modulations between the GNG and the SNG conditions at 130-220 ms, 230-300 ms and 330-500 ms.

→ Topographic modulation from 150 to 200 ms, indicating the engagement of distinct brain generators between the selective and the global inhibition conditions.

e. Source estimations: Time-wise GNG vs SNG t-tests



e. Time-wise t-tests on the source estimations. The total number of solution nodes showing a significant ($p<0.05$) difference at each TF is plotted.



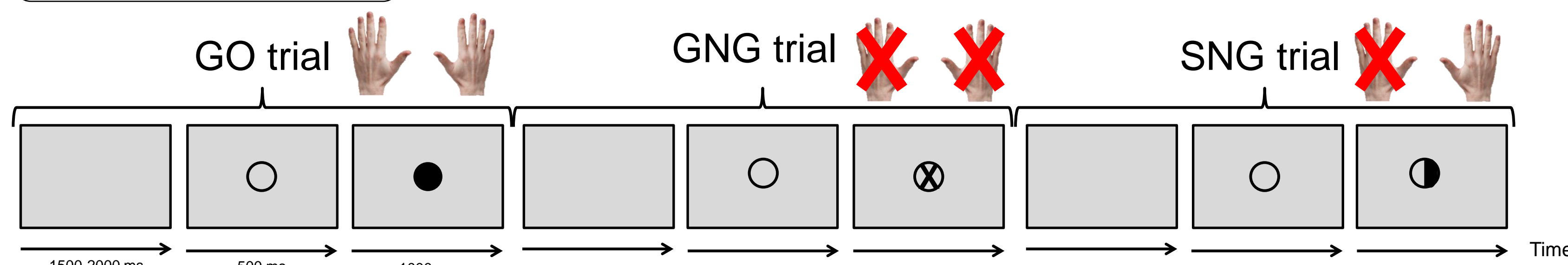
f. The results of the t-tests (significant t-values) are projected on a template brain for these two time-frames (130 and 190 ms). The negative t-values (purple color) indicate the brain regions more activated in the SNG than in the GNG condition; the red values indicate the brain regions more activated in the GNG than in the SNG condition.

Methods

Participants

- 18 young participants [9 males; aged 25 ± 3 years, Mean \pm SD, range: 21-29].

Go-Nogo task



[1] Coxon JP, Stinear CM, Byblow WD, 2007. Selective inhibition of movement. J Neurophysiol.
[2] Aron AR and Verbruggen F, 2008. Stop the press: dissociating a selective from a global mechanism for stopping. Psychol Sci.

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Behavioral results

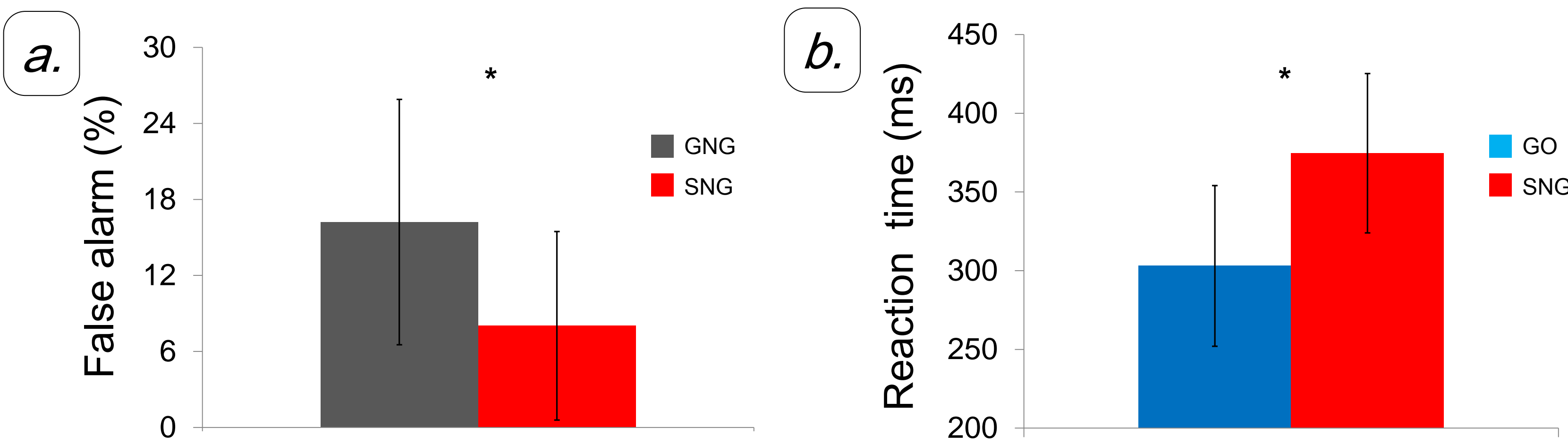


Figure a. Percentage of False alarms in the GNG (black) and the SNG (red) conditions. b. Mean response time \pm SD in the Go (blue) and the SNG (red) conditions.